O&M (2)

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DCI/IC 73-0884
14 August 1973

25X1 MEMORANDUM FOR:

SUBJECT : Current Intelligence Operations Improvements

REFERENCE : Memo for the Record; Subj: Meeting on Secure Voice Conferencing, 3 August 1973; dtd 7 August 1973; Secret

25X1 25X1 1. Per your request and I met with 25X1 to discuss improvements for current intelligence operations. This memo will delineate the areas reviewed in order of priority and discuss the status of each item.

2. Watch Officers' Secure Voice Conference Net. NSA, at our request and at essentially no cost, installed a five(5) port bridge in the National SIGINT Operations Center (NSOC) on the gray telephone system at NSA approximately six weeks ago. This capability permits the five operations centers (NSA, CIA, DIA, State & NMCC-JCS) to operate in a secure voice conference mode. Since available equipment (the bridge) was used, only five phones can be conferenced at once; however, since this is a "dial-up" conference (this requires the caller to dial the bridge operator who in turn calls all other conferees), anyone having a gray phone can be included in the conference at the request of the originator. The following modest improvements are to be made to the net: use of an operator headset and hand microphone or AT&T speaker-phone with hand held microphones, telephone line level adjustments, etc. Other more sophisticated improvements will be based upon needs and availability of funds and facilities (see Reference); e.g., making the net a "meet-me" conference (when the caller dials a number the phones of the other conferees will automatically ring). A "crash" type of conference is also being investigated. This is similar to the "meet-me" conference, but it also includes a priority interrupt in the event the phone is already in use. The WHSR will also be included in the Watch Officer Secure Voice Conference Net as soon as their needs are clarified. NSA is preparing the conference set-up procedures.
25X1 is preparing a test and exercise plan which will evolve into a conference procedure document. in conjunction 25X1 with key personnel of the operations centers, will prepare a use procedure document which will delineate minimum conditions necessary for the establishment of a conference call. As soon as these action items have been completed, the net will be operational.

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3. Analysts' Secure Voice Conference Net. This conference net is similar to the Watch Officers' net; however, this net would be used by intelligence community analysts and in conjunction with the IC Text Editing Communications System. It is envisioned that approximately six locations and ten phones could be conferenced at one time. The locations would be as follows: CIA, State, DIA, NSA, NMCC-JCS and the White House. The quickest and most economical solution is the installation of a bridge on the CIA green/gray switch. This would permit conferencing between green and gray phones. Similar improvements discussed above and in the Reference will be considered for this net.

A Senior Authorities secure voice conferencing net can be developed as required. It is envisioned that this net could be used by WSAG, NSCIC, USIB principals or whomever are designated for this net. The requirements for the capability are lacking not the technology to implement this net. This net would have very stringent control over who is connected to the conference in order to assure the confidentiality of sensitive matters. Depending upon requirements and how the analysts' Secure Voice Conference Net is engineered this net may satisfy the needs of the Senior Authorities.

Action Required. A multi-addressee memorandum should be prepared and sent to the principals proposing the establishment of this analyst net, requesting comments regarding the use of the net and guidance regarding the minimum number of phones required at each agency (no more than two envisioned at this time) and proposed locations.. Assuming that approval will be received, a memorandum will be prepared for the Chief, Office of Communications, CIA, requesting Commo to install and maintain this bridge. A simple "meet-me" bridge could cost as little as [redacted], assuming that existing phone lines are available at each agency and no new lines will have to be installed. When these action items have been completed, appropriate procedures will be written for the use of this net.

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4. Automatic Dialing Set. Attachment A describes an AT&T Magicall automatic dialing set. It is slightly smaller than a telephone and comes in two versions. One can hold 400 telephone numbers, the other can hold 1,000 numbers. It can be programmed for extension calls, red lines, black lines or long distance calls and it is fast and accurate. A demonstration was arranged for the Chief, CIA Operations Center and a copy of Attachment A was given to him. It appears that an automatic dialer of this type can serve a useful purpose in operations centers where the list of key



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people is long (1,000 names in the CIA telephone list finder) and urgency is great to locate people. The IC secure voice conference call number could also be listed on automatic dialers.

Action Required. The installation of this device has been left to the descretion of the Chief of the CIA Operations Center. This capability will be brought to the attention of the other operations centers.

56. Text Editing Communications Net. We have been investigating the need for and technical approaches that can be taken to improve by expediting, and therefore in some instances provide inputs not otherwise possible within defined time constraints, coordination of action memoranda among members of the intelligence community during crises or periods of increased tensions. We have also considered the use of the capability for daily coordination of CIBs, NIEs, SNIEs, Watch Officer Bulletins, W.O. Summaries or time urgent memoranda/position papers.

There are two basic benefits that can be obtained by achieving this capability; i.e.: (a) an improvement in the coordination process and cycle time, and (b) an improvement in this communications media will assist in bringing the intelligence community closer together.

Growth capabilities for the Text Editing Communications Net would include: (a) file manipulation, to include some of the features on [redacted] system, (b) an ability to connect to the CIA host computer, and (c) an ability to connect to the IDHS, WWMCCS and COINS networks.

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The system considered has been sized to have two CRT (Cathode Ray Tubes) and a printer (selectric typewriter) at each of six locations. They are: CIA (also for use by DCI), NSA, State, DIA, JCS and WHSR. An individual at each location would be able to type a document and have it displayed on his CRT. He will be able to insert characters, words, sentences, paragraphs and pages as well as delete the same. The system will automatically left justify and do line wrap-around. He will also be able to transpose characters, words, sentences, paragraphs and pages. When his document is complete he will have the ability to transmit it to one or up to five other locations. Using the analysts' Secure Voice Conferencing net, the IC will be able to discuss the action document and make changes using the CRT. When concurrence has been reached a hard copy can be printed at each location. An interface with a Magnetic Tape Selectric Typewriter (MTST) and a Magnetic Card Selectric Typewriter (MCST) will be options of the system.

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Three different technical approaches for the text editing system have been examined. They are: (a) a stand-alone, essentially point-to-point, system; (b) use of a large centralized computer (e.g., UNIVAC 494 at NSA) system; and (c) a small stand-alone computer system--expandable in the number of terminals that can be connected, flexible in that it can be tied to other host computers in a network in the future and with a growth capability to assist the analyst with his job. Approach c is preferred. An investigation/study report is being written which will include cost and capability comparisons and a recommended course of action.

It is envisioned that the system will operate at the SI/TK level and that appropriate actions and/or waivers will have to be granted for TEMPEST. [redacted] 25X1

25X1 [redacted]

Action Required. As soon as the investigation/study report has been written and reviewed in the IC Staff, it is proposed that a multi-addressee memorandum be sent to the agencies discussed above requesting their concurrence in this proposed action. Estimated costs run as low as [redacted] 25X1
price for one approach and up to about [redacted] 25X1
costs for another. It is recommended that the IC Staff fund for this capability with each agency paying for the leased line costs (2400 B/SEC telephone line). After approval has been secured it is proposed that the CPU be installed in CIA Headquarters and that the Office of the Joint Computer Services be assigned responsibility to oversee development, installation and to operate and maintain the system. The Office of Communications would be tasked with the assignment of working with OJCS to coordinate the communications circuits required at each agency. An appropriate memorandum would be prepared for the D/DCI/IC addressed to the Director, OJCS and the Director, OC requesting this action.

When these actions have been completed, appropriate procedures will be written for the use of this net.

6 7. IC Secure TV Network. Six(6) RCA Globecom Videovoice slow-scan leased TV terminals have been installed at the following locations for a 90 day test period: CIA Operations Center, State Operations Center, NSOC (National SIGINT Operations Center), NPIC (National Photographic Interpretation Center), NMCC (National Military Command Center) - JCS, and the NMIC (National Military Intelligence Center) - DIA. A recommendation will be made prior to 20 September 1973 relative to returning the equipment by 20 October 1973 or retaining the equipment beyond this date.

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Funds for the 90 day test came from IHC/IC funding. If the participating agencies decide to retain the equipment they will individually fund for these terminals. To date the tests have been proceeding quite smoothly; however, it's too early yet to predict the ultimate outcome. The purpose of the test is to determine whether or not there are valid needs for a capability of this type to transmit maps, charts, graphs, textual and imagery between operation centers. The following alternatives are anticipated:

Alt. A - Return equipment to RCA Globecom since no requirement exists at this time.

Alt. B - Retain equipment while a higher resolution (greater than 400 line TV - perhaps 1500 or 2000 lines) - faster (greater than 55 seconds transmission time - perhaps 6 seconds) system is developed.

Alt. C - Retain equipment and request RCA Globecom to make modest improvements (which we would have to fund) to the equipment. (These improvements could include the following: optional wide angle, telephoto or zoom lens, TV monitor integral to the TV camera, improved speaker phone, better archival recorder and improved hard copy printer/camera etc.)

Alt. D - Return equipment on the basis that a capability of this sort is required but the equipment has too many deficiencies. Develop an improved system having perhaps 1500 or 2000 line resolution, wide angle telephoto or zoom lens, and faster transmission times or a remote possibility, at this time, would be a need for a real-time closed circuit high resolution TV system.

A limitation of the present system appears to be the quality and reliability and number of phone lines available, at each location, on the gray phone system; therefore, some of the alternatives above may include improvements to the communications system.

Action Required. At this time no action is required.

18. Improved LDX. The present WASHFAX LDX operates over 50KB/SEC lines, It will only transmit textual material (no shades of gray - black or white) having a resolution of 200 l.p.i. @ 90 seconds transmission time. Attachment B is a specification sheet and description of the DACOM Model 412 Securefax unit. It can transmit with a resolution of 200 l.p.i. @ 90 seconds over a normal telephone line (4800/2400 B/SEC). This means the O&M costs are lower for a system having the same resolution and same transmission time. Another advantage is that the unit is supposed

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Action Required. It is proposed that a meeting with CIA-OC, DCA and other appropriate personnel be held to review existing plans to update WASHFAX and to consider the use of DACOM or similar "LDX" type units. Based upon the outcome of this meeting appropriate recommendations will be made.

8 9. IC Secure Facsimile System. Attachment C is a photograph received over a DATALOG - LITTON Systems facsimile terminal. The quality of the photograph is excellent. The transmission rate is approximately three minutes with a resolution of 100 lines per inch. A facsimile system of this type could service the Intelligence Community if it can be shown that there are cost benefits to be derived from this capability. The system is to be installed in a simplex configuration with the transmitter at NPIC and the receiver at the State Department Operations Center for a 30 day test period. I have made tentative arrangements, contingent upon key people witnessing the test, to have the receive terminal moved to the CIA Operations Center for an additional 30 day test period. This system could complement the IC Secure TV System. That is, a photograph could be viewed on the TV screen and if a hard copy is required it could be transmitted via the facsimile system.

Action Required. None at this time. We will continue to monitor the status of the LITTON development and other facsimile systems. If it appears advantageous arrangments will be made to have the LITTON System receive terminal installed in the CIA Operations Center for a 30 day test.

9 10. Electrowriter. There are a couple of devices that would permit using an overlay paper on top of a CIB type map and write alpha-numerics or draw lines that would be transmitted to a remote site having a similar set-up. One concept would be to acoustically couple this equipment to the gray phone system. This would permit operation center watch officers to communicate in this manner in addition to verbally discussing the items drawn on the overlay.

Action Required. We are obtaining additional technical data on devices of this type. Discussions will be held with IC agencies personnel on the worth of this capability. Possible recommendations could include purchasing devices of this type (approximately [redacted] for a small format unit) or leasing units for a 90 day test with the option to buy or continue to lease.

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10 11. IC Communications Improvements. All of the ten items discussed above will require some additional communications or improvements to existing communications systems. Some of these additions/improvements can be handled on a case-by-case basis. Depending upon the actions forthcoming an overall improvement plan for the systems communications should be developed.

Action Required. None at this time. It is proposed in the reorganization plan for the IHC (Intelligence Information Handling Committee) that the ad hoc USIB Telecommunications Working Group be integrated into the IHC. If this is done this will be the group that will develop a comprehensive telecommunications plan.

11 12. Summary. It is recommended that all of the items discussed above be acted upon according to the suggestions in each paragraph.

Action Required. These actions can be accomplished under the guidance of the IHC per the proposed reorganization plans submitted to the D/DCI/IC, the DD/DCI/IC and [redacted] 25X1
Should the decision be made to retain the IHC as a USIB committee, the actions recommended above could also be performed by the IHC in conjunction with the PRG. Somewhat similar studies encompassing these areas have been conducted in the past by the IHC (IWIN - Indications & Warning Intelligence & Study, IDEW - Intelligence Data Exchange Washington - Study and TETRAHEDRON - Telecommunications Study); however no decisions were made regarding the study recommendations by the IHC or USIB.

[redacted] 25X1

Chief, IHC/SS

25X1 cc: [redacted]

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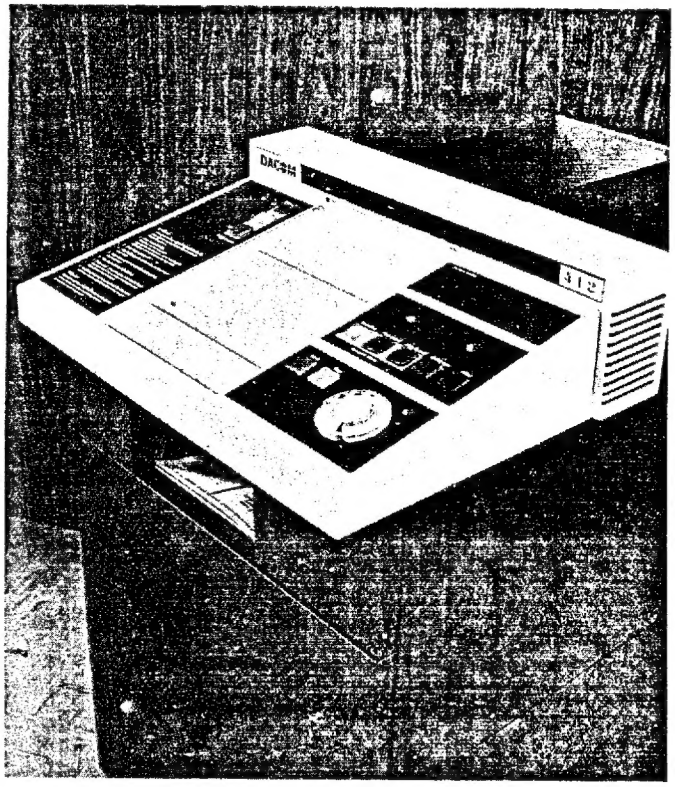
# DACOM

## MODEL 412 SECUREFAX

Digital Document Facsimile Transceiver



- SUB-MINUTE TRANSMISSIONS
- NON-CONDITIONED VOICE GRADE LINES
- OPERATES OVER DDD NETWORK
- UNATTENDED RECEIVE OPERATION
- SELECTABLE RESOLUTION
- FLAT BED SCANNER
- CONNECTS TO DAA
- CRYPTO INTERFACE
- ELECTROGRAPHIC PRINTER
- EASY TO OPERATE

The Dacom *Model 412* is a new and unique facsimile transceiver employing data compression. It has operating characteristics which collectively surpass any other equipment available today. System features include digital transmission, high speed, high quality, extensive automation, secure mode, internal paper supply, adaptively equalized modem, and reasonable cost.

The *Model 412* was designed to provide fast transfer of letter size documents between offices using ordinary telephone lines. The cost per page is approximately the cost of a special delivery letter.

Installation consists of connecting the unit to a telephone line through a DAA (Data Access Arrangement) which is furnished by the telephone company and costs only a few dollars a month. For secure communications crypto equipment must be provided. The *412* is supplied with the necessary interface connections for crypto units.

Any number of *412* transceivers may be connected in a network. The circuits may be WATS lines, tie lines, private lines, Autovon, microwave, satellite, or simply direct distance dialing like an ordinary telephone.

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## SYSTEM DESCRIPTION

The Dacom *Model 412* is a complete operating facsimile transceiver in a console configuration, based on advanced state-of-the-art technology throughout. Electronic circuitry has been reduced largely to LSI/MOS chips. Digital data compression results in exceptional speed and quality performance characteristics. A new modem with adaptive equalization permits full speed transmission through switched, non-conditioned voice grade lines, as well as two way coordination, status, annunciation and control. Verification of receipt of message is automatic. An electrographic stationary stylus printer produces high contrast copies on white, bond like dielectric paper.

The *412* is intended for automatic transmission of most types of graphic forms such as typewritten and handwritten letters, charts, drawings, sketches, diagrams, and maps in both clear and crypto modes. An 8½" X 11" document may be transmitted in less than one minute with a received resolution of 200 lines per inch in the horizontal dimension and 100 lines per inch vertically. Alternate resolutions available are 200 lines per inch vertically when finer resolution is desired, and 67 lines per inch when speeds in the 30 second range are required. The horizontal resolution is always 200 lines per inch. Pushbuttons on the console may be used to select resolution, page size, multipage mode or compensate for a noisy line. An automatic stack feeder (optional), automatic answer and internal paper supply permit operation with a very minimum of operator attention.

Operation is extremely simple, about the complexity of operating an office copy machine. Place the document face down on the console and move it forward to activate the system. Pick up the telephone and dial the desired number. When an answer tone is heard, hang up the telephone — that's all. The machines then "handshake" for a few seconds, verifying line conditions, equalizing the modems, and automatically establishing set-up functions (paper size, resolution, data rate, etc.). The "Transmit" light turns on and the document moves through the scanner (always in sight), then drops into a tray. After transmission the light goes out and both machines "hang up". If the "multipage" button has been pushed, the line is held open so that redialing is unnecessary. "Handshaking" occurs between each document to assure that every document is transmitted successfully.

At the receive terminal the machine automatically answers, prints the page, deposits it in a tray, informs the sending station that the document was received and readies itself for the next message. No operator needs to be present.

## TERMINAL SPECIFICATIONS

| | |
|---|---|
| **Document Size** | Any size up to 8½" wide by 14" long |
| **Communication Line** | Voice Grade, switched, non-conditioned line |
| **Line Interface** | Interfaces with Data Access Arrangement (DAA) |
| **Secure Mode** | Complies with MIL-STD-188C (±6 V Polar) |
| **Scanner** | Flat bed, optical, 200 lines per inch |
| **Copy paper** | (1,000 ft.) roll, white, dielectric, 8½" wide, cut to length, 5½", 11" or 14" |
| **Transmission Time** | Average density text, 8½" X 11" page: |

| Vertical Resolution | Horizontal Resolution | Speed |
|---|---|---|
| 67 lpi | 200 lpi | 35-45 sec. |
| 100 lpi | 200 lpi | 50-60 sec. |
| 200 lpi | 200 lpi | 1½-2 min. |

| | |
|---|---|
| **Modem** | 4800/2400 bps adaptively equalized, half duplex (full duplex optional) |
| **Power per Terminal** | 115 VAC, ±10%, 50/60 Hz, 9A, single phase (230 V optional) |
| **Console Size** | Height—39" Width—25" Depth—33" |
| **Console Weight** | 375 lbs. |
| **Modem Size** | Height—5¼" Width—19" Depth—19½" |
| **Modem Weight** | 30 lbs. |

# 14K W/ MODEM
# 10K - TERMINAL
# 300/MO

For further information contact:

DACOM

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Dacom,Inc., 1060 Morse Ave., Sunnyvale, California 94086 Phone (408) 734-3710

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# digital-fax its significance to the military

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FACSIMILE HAS BEEN used by the military for many years, but its widespread application, except in specialized areas, has been amazingly slow in coming. On a superficial level this is surprising since facsimile offers the military user a number of unique advantages of particular importance and usefulness relative to the military mandate and mission.

Facsimile can minimize the time interval in completing one of the most vital military communication tasks—the delivery of a message for action and implementation.

The great bulk of written military communications is accomplished using teletype devices. Teletype will continue to be used because its vast switched network is installed and in operation, people know how to use it, and it does the job. However, compared to facsimile, teletype has two basic limitations: 1) It requires a skilled human operator, 2) It cannot transmit graphics. The human operator is deficient in two basic areas: 1) He introduces a time delay because he is relatively slow, and 2) he makes errors. Facsimile avoids these problems. The information on a document requires no further preparation, and human induced errors are non-existent. Of course, both teletype and facsimile are subject to communication line errors or garbling, but a garbled facsimile signal will not misspell a word or modify the meaning of a sentence. Not so with teletype.

Optical character recognition (OCR), a relatively recent arrival, has been used to circumvent the teletype problems mentioned above. OCR has the advantage of phenomenal speed. Errors, while existent, can be identified and limited to a certain extent. However, with OCR another problem is experienced. The more versatile its reading ability, the greater the complexity and thus the expense of the terminal equipment. A given OCR device is programmed to read a pre-determined variety of letters, numbers and symbols. A character of different shape or size will be re-

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jected. Enlargement of the repertoire of readable characters is possible only at increased cost. In facsimile, the information appearing on documents is scanned microscopically and transmitted regardless of its design or geometric shape; errors in electronic interpretation do not occur. Furthermore, facsimile is enormously more flexible than OCR or teletype since it can convey maps, sketches, drawings, and handwritten copy in addition to alphanumeric and symbolic information. Facsimile is fluent in all languages, including Japanese, Chinese and others that pose real problems with conventional communication terminals. Of course, other types of communication media are used to move information, such as, mail, courier, telephone and television, but the application distinction vis-a-vis facsimile are more evident than with teletype and OCR.

Facsimile has one more advantage over other electronic means for transmitting messages and documentary information—it is potentially lower in overall cost. Simply put, if the cost of operator time, terminal equipment, line costs, and other communication expenses are taken into account the cost per message with facsimile will often come out ahead.

With all the advantages cited above, why is it that facsimile has not played a more prominent role throughout military communications and not just in specialized areas? The reason is that facsimile, up to the present time, has been deficient in a number of significant areas. A discussion of these deficiencies and how they have been overcome in newly introduced digital data compression facsimile equipment is the subject of this article. While not all the deficiencies discussed below are concentrated in any one type facsimile unit, one or more of these problem areas is usually found evident in any model examined.

### *Analog Facsimile*

Excessively long transmission time has been one of the most annoying characteristics of equipment to date. Most standard facsimile terminals are analog in design and require approximately six minutes for a "standard transmission." Since there are a great variety of modes in which a facsimile unit can operate, one must be careful to define the assumptions underlying a stated parameter. When we speak of standard transmission we are referring to transmission of an 8½ x 11 inch page over a non-conditioned voice grade line (600-2700 Hz), with a horizontal and vertical resolution of approximately 100 scan lines per inch which is adequate for reading typewritten material.

It should be noted that there are units recently placed on the market which are capable of standard transmission of three minutes or less. However, it is the authors' understanding that such units are more liable to distortions caused by line interference than the six minute versions, and the most successful applications have occurred over relatively short distances or over lines with especially good quality.

The time taken to transmit multiple pages at six minutes per page causes diversion of line from voice use for excessive periods, increases communication line costs, and unduly [illegible]

A second prominent obstacle to greater military use of facsimile is in the area of copy quality. Copy quality can be viewed by two criteria: 1) line resolution, and 2) page appearance. The resolution of a standard transmission is completely satisfactory for about eight point type or larger (about what one would find on an ordinary typewritten page). Any smaller type would often be difficult to read. Telephone page listings or newspaper baseball scoreboard information for example would be close to indiscernible. Since a great deal of printed matter is composed of very small type, such material simply cannot be successfully conveyed by a "standard" analog facsimile transmission.

The other part of the copy quality question is paper appearance. While much progress has been made in this area it is fair to say that many of the facsimile machines operating today utilize paper which is typically gray, crinkly, limp, difficult to file, and aesthetically less than pleasing.

Imposition of security provisions have always constituted a non-trivial set of problems for communication equipment. This is particularly true for facsimile terminals. Problems have occurred in two areas. The first has been the degrading effect of processing analog facsimile signals through crypto equipment. The second difficulty has come about in trying to eliminate the radiation of intelligible radio frequency emissions from the facsimile terminals. With respect to the question of radio frequency emission suppression, the facsimile industry has always solved this problem when required, however, it has most often been done with a significant cost penalty.

Government encryption equipment is normally digital in nature. Roughly speaking, the bits of a digital stream within the crypto equipment are "scrambled" for transmission over the communication line and then put back in the original bit stream order at the decoding station. In order to be scrambled, the analog signal from the facsimile scanner must be converted to a digital form. Ordinarily, such conversion entails a bandwidth expansion. If extra bandwidth is not available, such as when voice grade telephone lines are used, then the signal must be degraded to some extent. The net result of this analog to digital conversion process is often degraded received facsimile copy.

Other factors which have also served to curtail the use of facsimile within the military, have been lack of compatibility between facsimile types, manual operation of some models, sensitivity to communication line interferences, and problems in reliability and maintenance. It should be again emphasized that the array of problem areas mentioned above by no means exists in all machines. However, it should also be stated that when an attempt has been made with analog systems to eliminate, or substantially reduce, all of these limiting characteristics, the resulting terminal costs have made the use of such units justifiable only in instances in which expense is not a prime factor.

### *Digital Data Compression Facsimile*

The emergence of secure digital facsimile as a practical, cost effective medium with features far exceeding [illegible] is the result of the development

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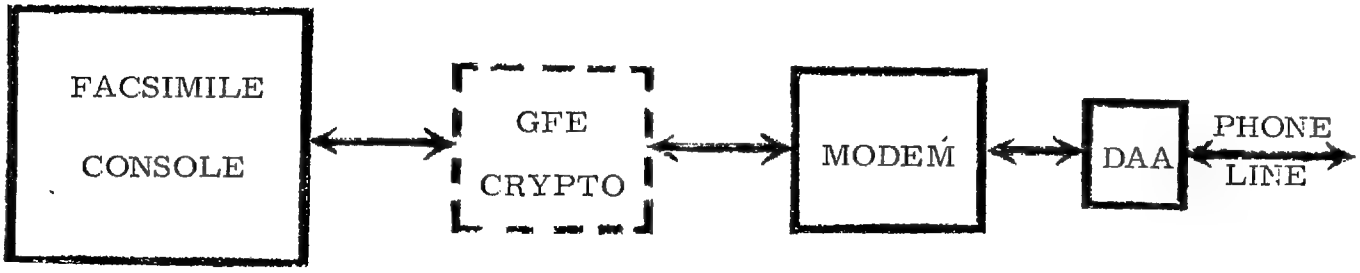


*Fig. 1. Digital Facsimile Terminal*

and practical application of a number of new and exciting technologies. These developments, related directly to advancements in digital equipment and techniques are:

1. Miniaturization and fabrication of electronic components employing large scale integration and metal oxide simi-conductors (LSI/MOS).
2. The development and practical implementation of extremely efficient data compression algorithms (codes.)
3. The development of high speed modulation/demodulation devices (modems) capable of operating at low error rates over switched non-conditioned voice grade lines.

At the same time that these developments have taken place the whole telecommunications transmission facility is being converted with increasing rapidity from analog to digital. Digital facsimile is able to take advantage of a myriad of performance flexibilities and cost benefits resulting from the change over.

### *Description of Digital Facsimile Terminal*

The digital data compression system employs the same basic functional components as analog equipment, with the distinction that digital components and techniques serve to enhance system performance characteristics.

A scanning device picks up light reflected off the original document. The signal from the scanning detector is converted into a digital bit stream. The bit stream is then introduced into the compression circuitry where a code is applied to reduce the number of bits necessary to convey the scanned information. The output of the compressor is directed to the transmit section of the modem where it is changed into a modulated carrier for transmission over a conventional telephone channel. At the receive terminal the complementary functions occur. The digital output of the modem is expanded in the data reconstructor to its original bit stream to activate a printing mechanism. Figure 1 shows a diagram of the functional elements of a digital facsimile terminal. Note: For secure applications, a crypto unit is placed between the facsimile system and the associated modem as shown. When operated over the direct distance dialing (DDD) switched network, a Data Access Arrangement (DAA), is also employed.

### *Speed*

The combined effect of data compression and high speed modem technology substantially reduces transmission time. For the "standard" transmission of the new digital facsimile, a 250 word typewritten message can be transmitted in less than one minute, or a 600 per cent improvement over the typical analog facsimile unit in use today.

Note: Such speeds are routinely achieved over trans-continental distances at modem rates of 4800 bits per second using voice grade DDD telephone lines.

This increase in speed significantly enhances the possibility of real time facsimile in many applications. For example, while previously a ten page plan or report would require one hour of transmission time, a digital compression facsimile system takes less than ten minutes. The high speed permits visually-aided telephone conversations at costs far lower than closed circuit TV.

### *Copy Quality*

One of the most useful benefits of digital data com-

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pression, in addition to speed, is its ability to provide increased resolution with minimum time or bandwidth penalty. In order to transmit fine line information or small text, resolutions higher than 100 lines per inch are needed. If the resolution is increased in an analog facsimile machine from 100 lines per inch to 200 lines per inch in both horizontal and vertical, the number of "dots" which must be transmitted increases by a factor of four. Thus, a six minute transmission at 100 lines per inch would increase to a 24 minute transmission time at 200 lines per inch, over the same telephone channel.

In some digital data compression systems, however, for reasons which go beyond the scope of this discussion, time increases only by a factor two. Since the transmission time is low to begin with, this factor of two imposes a minimum time penalty. That is, a one minute transmission at 100 lines per inch becomes only a two minute transmission at 200 lines per inch. Thus digital data compression facsimile systems overcome the severe time limitation imposed when transmission of fine detail is desired. At 200 lines per inch with transmission times of two minutes or less, pages with information barely discernible to the human eye can be transmitted and reproduced legibly. Since military maps, diagrams, drawings, and printed material often contain such fine detail, much more data can now be successfully transmitted over voice grade lines in a reasonable time.

### *Secure Communications*

Because the output of the new facsimile systems are digital in format, they suffer no degradation whatsoever when processed through standard government-furnished encryption equipment. In addition, problems of interface, synchronization and signal "handshake" are minimized because both the facsimile and crypto equipment are of the same digital character.

In the area of meeting government standards for radio frequency emission, digital circuitry, and LSI "chips" have a real advantage. The low voltages utilized have inherently low radiation characteristics. If solid state or quasi-solid state scanning and printing devices are used, then the radiation problems are further minimized. Under ideal circumstances no external shielding would be required to meet federal standards for secure operation. One of the severest problems has thus been set aside if the equipment can be made to meet federal standards with relative ease.

### *Flexibility*

One of the most impressive characteristics of recently appearing digital facsimile systems is flexibility of performance and compatibility with other equipment and systems. The flexibilities include its ability to operate without modification over varying bandwidths, its ability to operate over digital transmission networks as well as the normal analog circuits, its compatibility with store and forward devices, switching systems, polling, broadcast routines and error correction techniques.

Digital data compression facsimile systems of the type discussed here are "slaved" from a speed standpoint to the clock rate provided by the associated digital modem or an externally provided clock. If the terminal is required to operate over a narrow band or low quality channel, the clock rate can be reduced so that the equipment operates at a low transmission rate sufficient to communicate without excessive error. Equipment of this type has been operated for the U.S. Navy over HF radio links at bit rates as low as 75 bits per second. No degradation of copy quality occurs even at these low transmission rates and accompanying narrow bandwidths.

One of the intriguing applications recently demonstrated by the Defense Communication Agency (DCA) is the use of digital facsimile over digital networks such as AUTODIN. The advantages of operating digital facsimile over AUTODIN are that first, being a military switched network, most recipients of messages will be near message centers. Also, the network is secure, and finally, AUTODIN is designed for very low error rates, so that communication interference problems occurring on ordinary telephone lines do not normally occur. Thus problem free reliable transmission is assured.

### *Computer Compatibility*

The output of a digital facsimile may be stored on any of the media upon which computer output is stored. This includes magnetic tape, disc, or solid state memory. With compression, the efficiency of storage increases in proportion to the compression ratio. Storing and forwarding of fax messages is similar to store and forward systems for computer or teletype data. Other computer oriented functions such as message switching, polling of terminals, broadcast transmission, and error correction can be used with digital facsimile terminals. By employing such operations, a communication network can compensate for the variations in communication line loading, and thus accommodate a greater volume of digital traffic through the system. The use of these techniques permits much more economic operation of the network. The digital facsimile system fits smoothly into the computer-switched systems which are now being so successfully applied in many military communication areas.

The military must constantly search for the best, most advanced, yet cost effective, means available for accomplishing its vital missions. In the area of facsimile, newly introduced digital equipment offers to satisfy this requirement.

Greater resolution and better copy quality provide a wider diversity and depth of information to the recipient. This, coupled with a high transmission speed, results in vastly improved human communications and decision making. Compatibility with existing computer-controlled communication systems means that the benefits of these new systems can be readily applied to facsimile.

Consequently, digital data compression facsimile equipment may be expected to have wide and rapid acceptance in military communications.

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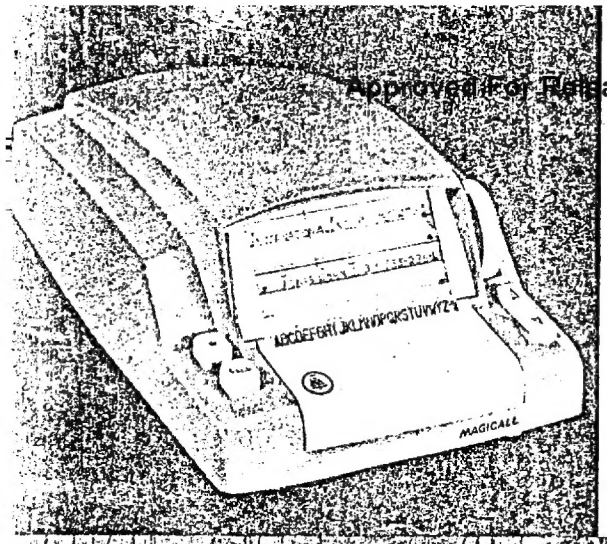

# MAGICALL*

## Automatic Dialing Set

A 12.50/mo & +25.00 INSTALL.
(400 capacity) (1000 cap) @ 35.00

dials any local, long distance or intercom number for you

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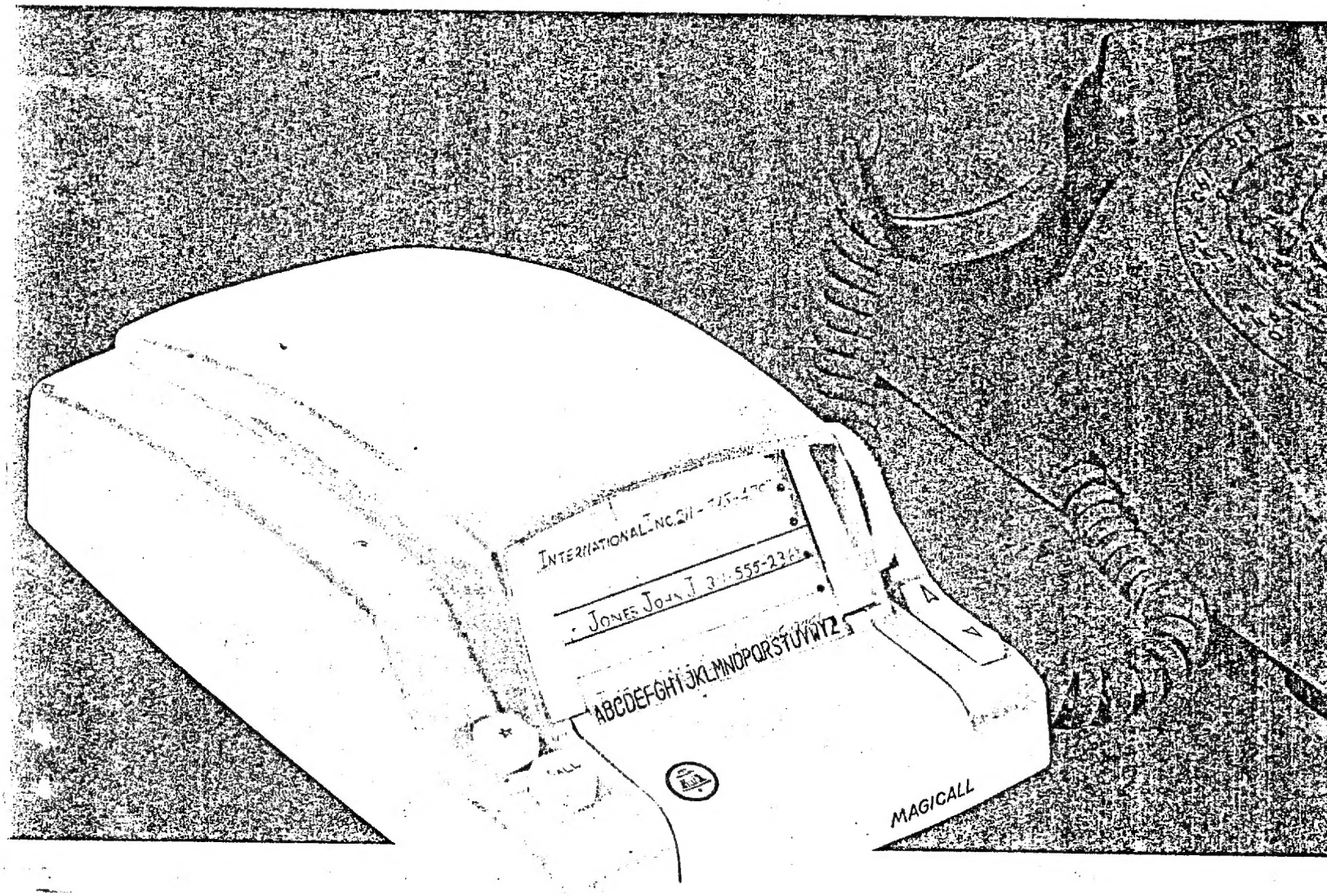
# MAGICALL

## AUTOMATIC DIALING SET




to call, merely locate desired number on motorized index, listen for dial tone, then push "call" button...

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# gives your business these benefits...

☐ SAVES TIME

- Makes telephoning effortless, accurate, more convenient.
- Easily dials all kinds of calls — local, long distance and intercom.

☐ "REMEMBERS" TELEPHONE NUMBERS

- No need to look up numbers — they are stored on magnetic tape and visibly indexed.
- Numbers may be easily recorded and changed.
- You avoid the "memory tricks" that sometimes mean delays or wrong numbers.

☐ MOTORIZED INDEX

- Permits rapid scanning and fast number selection.

☐ FLEXIBLE CAPACITY

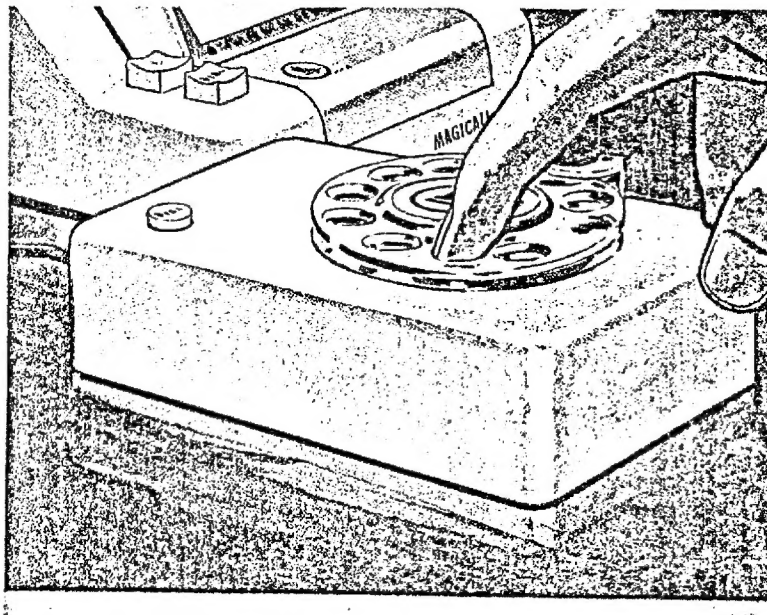
- Individual tape cartridges provide 400 or 1,000 number capacity.
- Several cartridges may be used to give additional capacity as needed.
- Cartridges are easily and quickly interchangeable.

☐ OTHER "PLUS" BENEFITS

- Requires little desk space — small, compact.
- Index entries can be quickly made in pencil.
- Use your telephone in the regular way at any time.
- No capital investment.
- Prompt, reliable Bell System maintenance at no extra cost.
- Available in decorator colors.

FOR THE EXECUTIVE, automatic dialing serves as a valuable "assist" in accomplishing more with substantially less effort.

FOR THE OFFICE WORKER making many outgoing calls, helps reduce fatigue, increase efficiency.



HANDY PLUG-IN DIAL, used to record numbers on magnetic tape, stores in desk drawer or other out-of-the-way place when not in use.

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# MAGICALL

## AUTOMATIC DIALING SET

**adds speed, accuracy and ease to your telephoning...**

### Saves You Time and Effort:

lets you reach your party quickly and conveniently without looking up numbers or dialing.

### Saves You Money:

speeds call-handling, boosts staff efficiency with motorized index and easy-to-operate equipment.

**Bell System**
American Telephone & Telegraph Co.
and Associated Companies

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